CLAIMS:

1. A method of forming a continuous glass shape of controlled cross-section, the method comprising pushing a glass rod into a melting chamber, melting the rod in the chamber, extruding molten glass in the chamber through a die to form a draw down, and pulling the glass draw down to form said shape.

2. The method of claim 1 further comprising measuring at least one process variable selected from the group consisting of a dimension of the draw down, a dimension of the shape, a temperature of the melting chamber, a dimension of the rod, and a pushing force on the rod, and controlling at least one of the rate of pushing the rod or the rate of pulling the glass shape in response to the measured variable.

3. The method of claim 2 wherein measuring at least one process variable comprises measuring an outside dimension of the shape.

4. The method of claim 2 wherein measuring at least one process variable comprises measuring an outside dimension of the draw down.

5. The method of claim 2 wherein measuring at least one process variable comprises measuring a temperature of the melting chamber.

6. The method of claim 2 wherein feeding the glass rod is continuously controlled in response to the measuring step.

7. The method of claim 2 wherein pulling the glass shape is continuously controlled in response to the measured variable.

8. The method of claim 2 wherein at least two of said process variables are measured.

9. The method of claim 1 wherein the rod and the shape are both substantially horizontal throughout the method.

10. A method of making a glass shape comprising a step of providing a heating chamber, the heating chamber having a single inlet and a single outlet, a step of pushing a solid glass rod into the inlet and a step of pulling a shape from the outlet.

11. The method of claim 10 wherein the inlet comprises a heated cone, the cone melting the exterior of the rod and forming a molten glass seal at the inlet.

12. A method of making a glass shape comprising a step of providing a heating chamber, the heating chamber having a single inlet and a single outlet, and a step of pushing a solid glass rod into the inlet, wherein the inlet comprises a heated cone, the cone melting the exterior of the rod and forming a molten glass seal at the inlet.

13. The method of claim 12 wherein the inlet has a diameter slightly smaller than the diameter of the rod.

14. The method of claim 13 wherein the rod has a diameter, which varies at least 0.5% and no more than 5%.

15. The method of claim 14 wherein the inlet has a diameter 0.5% to 5% smaller than the smallest diameter of the rod.

16. A method of continuously making a glass shape comprising a step of heating glass in a chamber, the chamber having an inlet and an outlet, and a step of feeding solid glass continuously to the inlet of the chamber with sufficient force to produce a pressure in the chamber which suppresses formation of air bubbles or air channels in the glass in the chamber.

17. The method of claim 16 wherein the solid glass is fed at a force of above about five kilograms.

18. The method of claim 17 wherein the molten glass is pulled away from the outlet.

19. The method of claim 16 wherein the solid glass is fed generally horizontally into the chamber.

20. The method of claim 16 wherein the solid glass comprises a plurality of solid glass pieces in abutting relationship.

21. The method of claim 16 wherein at least a portion of each glass piece is pushed into said inlet by a succeeding piece.

22. The method of claim 21 wherein the glass pieces are solid rods.

23. The method of claim 16 further comprising a hollow inner forming tube extending from the vicinity of the outlet through a wall of the chamber, the method comprising drawing air through the inner forming tube to form a glass tube.

24. A method of feeding glass into a melting chamber comprising guiding a solid glass piece having a generally uniform cross-section through a heater to soften an outer portion of the piece, and thereafter forcing the glass piece through a restriction smaller than the cross-section of the piece into the melting chamber.

25. The method of claim 24 wherein the melting chamber has an outlet, the outlet being cooler than the major portion of the melting chamber.

26. The method of claim 25 wherein forcing the glass piece through the restriction produces a softened glass seal at the restriction and produces pressure within the melting chamber.

27. An apparatus adapted to form a hollow tube, the apparatus comprising a heated chamber having an outlet, a die in the outlet, and a hollow inner forming tube extending from the vicinity of the outlet, within an inside dimension of the die, through a gland in a wall of the chamber.

28. The apparatus of claim 27 further comprising an adjustment device operatively attached to a part of the hollow inner forming tube outside the chamber.

29. The apparatus of claim 28 wherein the inner forming tube is straight, the apparatus further comprising an inlet passage having an axis parallel to the inner forming tube and offset from the inner forming tube.

30. The apparatus of claim 27 wherein the chamber is filled with molten glass, the glass being cooler adjacent the gland and adjacent the die than the average temperature of the glass in the chamber, the gland forming a seal of glass between the inner forming tube and an opening in a wall of the chamber.

31. An apparatus for feeding glass rod sections comprising a plurality of feed drives, at least one of the feed drives being biased into engagement with the rod, a sensor for detecting rod section ends, and a mechanism for varying the bias of the at least one feed drive in response to the sensor to protect the rod ends.

32. The apparatus of claim 31 wherein the rod ends are abutting.

33. A method of controlling the rate at which a rod of heat-softenable material is fed through a heated restriction, the restriction softening at least an

outer portion of the rod, the method comprising a step of determining changes in temperature at the restriction, and a step of controlling the rate of feeding the rod in response to changes in temperature at the restriction.

34. The method of claim 33 wherein the rod is solid.

35. The method of claim 33 wherein the rod is made of glass.

36. The method of claim 33 wherein the step of controlling the rate of feeding the rod maintains a constant mass per unit time of the material passing through the restriction.

37. The method of claim 34 wherein the restriction is the inlet of a melting chamber.

38. The method of claim 37 wherein the melting chamber includes an outlet, the material forming a draw down at the outlet.

39. A method of forming a shape of a heat-softenable material, the method comprising a step of feeding a solid rod of the material into a heated chamber through a heated restriction, a step of determining changes in temperature at the restriction, and a step of controlling the speed of feeding the rod in response to changes in temperature at the restriction.

40. A method of forming a continuous glass shape, the method comprising a step of feeding a glass rod into a melting chamber through a restriction, a step of determining a diameter of the glass rod being fed into the chamber by measuring a temperature at the restriction, and a step of controlling the speed of feeding the glass rod in response to the measured temperature at the restriction to control the rate of feed of glass into the chamber.

41. A method of forming a continuous glass shape of uniform cross-section, the method comprising a step of feeding a glass rod into a melting chamber through a restriction, a step of determining a diameter of the glass rod being fed into the chamber by measuring a temperature at the restriction, and a step of controlling the speed of feeding the glass rod in response to the measured temperature at the restriction to maintain a constant flow of glass into the chamber.

42. A method of forming a continuous glass shape of uniform cross-section, the method comprising a step of feeding a glass rod into a melting

chamber through a restriction, a step of determining changes in a temperature at the restriction, and a step of controlling the rate of flow of molten glass through the chamber in response to the changes in temperature at the restriction.

43. The method of claim 42 wherein the step of controlling the rate of flow comprises controlling the rate of feed of the rod.

44. The method of claim 42 wherein the step of controlling the rate of flow comprises controlling a rate of withdrawing molten glass from the chamber.

45. A method of forming a continuous glass shape of uniform cross-section, the method comprising a step of feeding a glass rod into a melting chamber through a restriction, a step of pulling the glass shape from the chamber, a step of determining changes in a temperature at the restriction, and a step of controlling at least one of the rate of feeding the glass rod and the rate of pulling the glass shape in response to the changes in temperature at the restriction.

46. The method of claim 45 wherein the restriction has a diameter no greater than the smallest diameter rod fed into the restriction.

47. A method of forming a shape of a heat-softenable material, the method comprising a step of feeding a solid rod of the material into a heated chamber, a step of determining changes in the diameter of the rod, and a step of controlling the speed of feeding the rod in response to changes in the diameter of the rod.

48. The method of claim 47 wherein the step of determining changes in the diameter of the rod comprises determining a change caused by entry of the rod into a restriction at an inlet of the chamber.

49. The method of claim 48 wherein the change is a change in temperature.

50. The method of claim 48 wherein the change is a change in force on the rod or the restriction.

51. A method of forming a shape of a heat-softenable material, the method comprising a step of feeding a solid rod of the material into a heated chamber, a step of pulling the shape from the chamber, a step of determining

changes in the diameter of the rod, and a step of controlling at least one of the rate of feeding the rod and the rate of pulling the shape in response to changes in the diameter of the rod.

52. The method of claim 51 wherein changes in the diameter of the rod are detected by changes in temperature at an inlet side of the chamber.

53. A method of controlling a quantity of glass fed through a molten glass-wetted gland, the method comprising pushing a glass rod through a heated passage defined by at least one passage wall to melt an outer portion of the rod, the melted glass contacting the passage wall and forming a seal with the wall, and a step of sensing cooling of the wall caused by the melted glass contacting the wall.

54. A method of continuously making a glass shape comprising a step of pushing glass into an inlet of a chamber, the chamber being heated by spaced electrodes attached to a wall of the chamber, and a step of pulling the glass shape from an outlet of the chamber.

55. The method of claim 54 wherein portions of walls of the chamber are formed of different thicknesses to produce a desired temperature profile within the chamber.

56. A method of forming a hollow shape from a heat-softenable material comprising softening the material, extruding it through a die, the die having an inner forming tube shaped and positioned to produce an internal passage in the shape, the inner forming tube being connected to a source of pressure or vacuum, the pressure or vacuum being controllable to affect at least one dimension of the shape.

57. The method of claim 1 wherein the melting chamber is cooler at an outlet than upstream in the chamber.

58. The method of claim 57 wherein separately controllable heaters are provided above and below the outlet.

59. The method of claim 1 wherein the die is adjustable relative to the chamber.

60. The method of claim 59 further comprising a hollow inner forming tube extending through the chamber to the vicinity of the die.

61. The method of claim 1 wherein at least one of the rate of pushing the rod and the rate of pulling the glass shape is varied cyclically to produce a shape having successively an inward and an outward taper.

62. The method of claim 1 further comprising a hollow inner forming tube extending from the vicinity of the outlet through a wall of the chamber, the method forming a glass tube.

63. The method of claim 62 wherein a downstream end of the inner forming tube is cyclically moved to produce a tube having an inner diameter which is successively larger and smaller relative to an outer diameter of the tube.